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3.0-MILLIMETER WAVELENGTH DUPLEXER

Report No. 5

DA-36-039-SC-89223
Task No. 1G6-22001-A-055-04

Fifth Quarterly Progress Report

15 April 1963 to 15 July 1963

ELECTRONICS COMMAND TECHNICAL REQUIREMENTS NO. SCL-7001/66

WESTINGHOUSE ELECTRIC CORPORATION
Electronic Tube Division
Applied Research Department
Microwave Tubes Section
Baltimore, Maryland

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The object of this contract is the development of a 3.2-mm band-pass duplexer and crystal protector.

Prepared by:

Stafford D. Schreyer

TABLE OF CONTENTS

1. PURPOSE

The object of the 3.0-millimeter wavelength duplexer program is the development of two gas switching devices for receiver protection over a frequency band of 91 to 96 gc. The applicable specifications are presented in Electronics Command Technical Requirements No. SCL-7001/66 dated 5 June 1961. One tube is a dual TR tube (Westinghouse designation WX-4954) for use in a balanced duplexer and the other tube is a crystal protector (WX-4953). The balanced duplexer shall operate at peak power levels of at least 10 kw and a duty cycle of 0.0005 while the crystal protector shall provide receiver crystal protection from peak power levels from 50 milliwatts to 1000 watts at a 0.0005 duty cycle.

Both tubes will be built in RG-99/U rectangular waveguide. The crystal protector tube will mate with UG-387/U cover flanges since the related microwave components are presently being developed in this waveguide size, while the dual TR tube will mate with the flanges on the TRG 3-db hybrid couplers.

A study program will be conducted concurrently with tube development to investigate the methods and the problems associated with duplexing in circular waveguides.

2. ABSTRACT

The work done during the Fifth Quarter was concerned with operation of the high power test facility. Two magnetrons were received and both had cathode failures after a few hours operation. However, some data on firing power of the TR stage and the keep-alive stage was obtained.

Since initial data showed the firing power of the keep-alive stage to be high, several modifications to the keep-alive structure were made. Unfortunately, these could be evaluated only at klystron power level since the magnetron had previously failed.

3. PUBLICATIONS, LECTURES, REPORTS, AND CONFERENCES

No publications or lectures were made during this reporting period.

Mr. E. Edwards visited Westinghouse, Baltimore, on May 14 and July 9, 1963 to review the program.

Mr. W. Cherry of Westinghouse visited the Signal Corps on June 12 to return one magnetron and to accept delivery of another.

4. FACTUAL DATA

4.1 HIGH POWER TEST

One RPB-3 magnetron used in this quarter oscillated at 89.9 gc. Although this frequency was out of the band of interest, it was believed that some high power breakdown data could be obtained since the crytsal protector tube could be resonated to pass this frequency. However, other components proved to offer too much attenuation at this frequency and its usefulness was limited. Its main use before it failed was in optimizing the modulator performance so that a clean rectangular pulse of about 0.15 microseconds was eventually obtained. Cause of failure was attributed to a bad cathode.

The second magnetron obtained during the quarter oscillated at 91.0 gc with a power output of 250 watts peak. It performed well for approximately two hours before its cathode also failed.

During the brief life of the second RPB-3 magnetron, some data was taken pertaining to the breakdown level of the keep-alive stage. A pressure of 55 Torr of Argon was found to give the lowest firing power of 1.75 watts peak. Subsequent changes were made in the keep-alive design but before they could be checked under high power conditions, the magnetron failed.

The TR or intermediate stage was also checked in the high power test setup. With a matched load behind, the tube fired at 120 watts peak. Under normal operation with the keep-alive stage behind it and fired, it is expected that the firing level will be reduced. Further work will be needed on this stage too.

4.2 LOW LEVEL MATCHING

At the present time, the design of the tube with respect to low level characteristics is almost complete. One item requiring some more work is the high Q window. The basic problem in the design of this element is one of mechanical tolerance.

The necessary redesign of the keep-alive electrode requires that the structure be remeasured to determine its low level properties. This is presently being done.

4.3 TUBE FABRICATION

To facilitate high power testing of a complete WX-4953 crystal protector tube, the design of the tube has been simplified. Components for the simplified tube are presently being made. The new design will permit more tubes to be built for evaluation purposes (assuming a magnetron can be had) in the time remaining.

5. CONCLUSIONS

Some high power testing has been achieved prior to cathode failure of the magnetron. Additional testing and completion of the program await additional RPB-3 magnetrons with suitable characteristics and life.

6. PROGRAM FOR NEXT INTERVAL

Fabrication of tubes will continue in anticipation of receiving a suitable magnetron. High power rf tests will be made then on fabricated tubes.

7. IDENTIFICATION OF KEY TECHNICAL PERSONNEL

Following is a list of the key personnel assigned to this program, along with the man-hours of work performed by each:

Personnel	Man-Hours
Gerald I. Klein	24
Stafford D. Schreyer	77.5
Theodore M. Nelson	20
James D. Woermbke	109

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This contract is supervised by the Microwave Tubes Branch, Electron Tubes Division, ECD, USAELRDL, Fort Monmouth, New Jersey. For further technical information, contact Mr. Edward V. Edwards, Project Engineer, Telephone 201-59-61742.

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3.0-MILLIMETER WAVELENGTH DUPLEXER
by Stafford D. Schreyer. Quarterly Progress Report No. 5, 15 April 1963 to 15 July 1963, 24 p.
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Unclassified report

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2. Duplexer
3. Crystal Protector

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II. Schreyer, S.D.
III. Westinghouse Electric Corporation, Air Arm Division, Baltimore, Maryland
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